

SINDULITES, A NEW GENUS OF THE NUMMULITIDAE (FORAMINIFERIDA)

by F. E. EAMES

ABSTRACT. *Operculina sindensis* L. M. Davies 1927 is made the type of a new genus *Sindulites* (Nummulitidae).

THE subgenus *Chordoperculinoides* Arni 1965 of the genus *Nummulites* was proposed to incorporate all real 'nummulites cordelées', and has as its type species *Operculina bermudezi* Palmer, a Caribbean Palaeocene species. However, Arni (1966) in discussing his subgenus gave two plates of illustrations of what he regarded to be '*Chordoperculinoides bermudezi* (Palmer)', but all his illustrated specimens had their origin in the Palaeocene of Libya. On the other hand, the writer's experience of Palaeocene foraminifera from Libya indicates to him that (a) none of the Libyan specimens illustrated by Arni (1966, pl. 1-2) are either conspecific or congeneric with *O. bermudezi*, and (b) the specimens illustrated by Arni (1966, pl. 2, figs. 9-11) are not the megalospheric generation of the microspheric form he illustrates (*ibid.*, figs. 7-8, 13-14), and probably belong to the genus *Operculina*.

DISCUSSION

The species *O. bermudezi* has been well illustrated by Cole (1953, pl. 1, figs. 5-7; pl. 2, fig. 4; pl. 3, figs. 2-12) and by Sachs (1957, pl. 14). The spiral lamina is coarsely perforate throughout, a feature which has led some authors to suggest that it belongs to the genus *Miscellanea*, but the presence of a well-developed perforate marginal cord precludes placing it in the family Miscellaneidae. The subgenus *Chordoperculinoides* as exemplified by its type species *O. bermudezi* is apparently restricted to the Palaeocene of the Caribbean region.

The species to which the Libyan megalospheric forms illustrated by Arni (1966) belong is known to the writer from work he has carried out on material from West Pakistan, India, and Libya; it is the form originally described by L. M. Davies (1927, *cum syn.*) as '*Operculina sindensis*', a species sometimes referred by some subsequent authors to the genus *Ranikothalia* Caudri, 1944. The species *O. sindensis* is here made the type of a new genus.

Family NUMMULITIDAE de Blainville, 1825

Genus SINDULITES gen. nov.

Type species. *Operculina sindensis* L. M. Davies (1927, p. 274, pl. 19, figs. 10-13), Palaeocene.

Diagnosis. Involute, axial section showing very long alar prolongations; wall structure as in *Nummulites* (i.e. not coarsely perforate except at the marginal cord); septal filaments visibly continuous from margin to centre on external surface; marginal cord

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developed into a strongly swollen and coarsely perforate structure; microspheric form little larger than and similar in form to the rather flat megalospheric form.

Remarks. It was Davies (1952) who first suggested that there might be a link between the Palaeocene larger foraminiferal faunas of the East and West Indies when he described *Ranikothalia sahnii* and its megalospheric form *R. savitriae* from West Africa. This species is very closely related to *S. sindensis*, is obviously congeneric with it, and might perhaps by some be considered conspecific with it. *Nummulites nuttalli* Davies 1927 is the type species of *Ranikothalia*, and it differs from the above forms in lacking a strongly swollen marginal cord and in its megalospheric form (*N. thalicus* Davies 1927) being considerably smaller and more inflated than the microspheric form. Prior to 1927, *N. nuttalli* had been referred to *N. planulatus* (Lamarck), 1804, and the writer considers that both *planulatus* and *nuttalli* are just lenticular *Nummulites* with rather numerous septa and high chambers in equatorial section, and that *Ranikothalia* is a synonym of *Nummulites*.

De Cizancourt and Cuvillier (1954) reported *Nummulites (Operculinoides) bermudezi* (Palmer) from the Palaeocene of Senegal. Only one text-figure, a line drawing of an axial section, was given. There is no indication of the coarse perforations in the spiral lamina, so well illustrated by Cole (1953) and Sachs (1957). De Cizancourt and Cuvillier also recorded several other Caribbean species from the Palaeocene in Senegal, but in all cases the illustrations consisted merely of line drawings, and in all cases but one only an axial section was illustrated. The writer would suggest that it is undesirable to identify firmly in Senegal a nummuloid species from the other side of the world on the basis of an axial section only, without any good indication of the wall structure and characters of the equatorial section.

Haynes (1962) recorded and illustrated from the Palaeocene of Libya a form he referred to as '*Operculina canalifera sindensis* (L. M. Davies)'. The quality and clarity of his illustrations are such that one can be quite sure that the wall structure is the same as that of *O. sindensis* (Davies) and that it lacks the coarse perforations in the spiral lamina so characteristic of *O. bermudezi* and excellently illustrated by Cole (1953) and Sachs (1957). However, Davies considered *O. canalifera* and *O. sindensis* to be different species, and Haynes evidently overlooked the fact that *O. canalifera* is completely evolute, whereas *O. sindensis* is completely involute. From what the writer has seen of these two forms in India and West Pakistan, he can confirm Haynes's identification of the taxon '*sindensis*' in Libya.

Castelain (1965) recorded the occurrence of 'probable' *Operculinoides bermudezi* from the Palaeocene of Senegal, and also the occurrence of four discocyclinid forms: *Discocyclina grimsdalei* Vaughan and Cole, *D. harrisoni* Vaughan, *D. barkeri* Vaughan and Cole, and *D. (vel Pseudophragmina (Atheocyclina)) soldadensis* Vaughan and Cole. There were no descriptions or illustrations at all, and the writer feels that it would be inadvisable to accept these identification of species from the other side of the world without further detailed information.

Arni (1966) recorded *Chordoperculinoidea bermudezi* from the Palaeocene of Libya. The microspheric forms illustrated by Arni (1966, pl. 1, figs. 1-6; pl. 2, figs. 7-8, 13-14) have all the characters of the genus *Sindulites* and of the taxon referred to as *sindensis* by Haynes (1962). The megalospheric forms illustrated by Arni (1966, pl. 2, figs. 9-11)

seem to be an *Operculina* rather than the A Form of *S. sindensis*. The megalosphere of *S. sindensis* is fairly large, that of a representative specimen from the Palaeocene of Libya being bilocular, the outside dimensions being: protoconch 0.42×0.34 mm., deutoconch 0.4×0.21 mm. The Palaeocene in Libya is richly fossiliferous, and quite a number of species of *Operculina* are known to occur in association with *S. sindensis*.

In my opinion the above information lends considerable doubt to the occurrence of Caribbean species of shallow water larger foraminifera in West Africa, and, if correct, it would avoid all the difficulty of trying to understand how they could have got from one side of the Atlantic Ocean to the other. All the forms now suggested to belong to the genus *Sindulites* occur in beds of Palaeocene age, the genus being known from West Pakistan, Somalia (unpublished information), Iran (unpublished information), Iraq (unpublished information), Libya, Sicily (unpublished information), and Togoland. It is relatively easy to comprehend how these species of *Sindulites* could have developed as a closely knit group in geographical continuity during Palaeocene times when it is recalled that the Palaeocene sea with its faunas extended from Indonesia through Burma and West Pakistan to the Middle East and East Africa, thereon through Egypt and Libya and the Sahara (Lake Tchad) to West Africa.

The species *sindensis* has at various times been referred to the genera *Operculina*, *Operculinoides*, *Nummulites*, *Ranikothalia*, *Miscellanea*, and the subgenus *Chordoperculinoides*, and now to the new genus *Sindulites*; the reasons why the species *sindensis* should not be referred to any of the first six taxa are:

(a) Except occasionally for the first whorl or two, *Operculina* is completely evolute, whereas *sindensis* is completely involute.

(b) *Operculinoides* and *Operculiella*, both of which are synonyms of *Palaeonummulites*, are miniature forms, even the microspheric form of which rarely exceeds 5 mm. in diameter, the nucleoconch of the megalospheric form rarely exceeding 0.15 mm.; *sindensis* is quite large, has a double nucleoconch each chamber of which is large, attaining a diameter of 0.4 mm. approximately, and the species possesses a very strongly swollen marginal cord which is not present in *Palaeonummulites*.

(c) *Nummulites* does not have a very strongly swollen marginal cord, and its megalospheric forms are considerably smaller and often much more inflated than the microspheric forms, in contrast to *sindensis*; on these bases *Ranikothalia* would be a synonym of *Nummulites*.

(d) *Miscellanea* lacks the perforate marginal cord of the Nummulitidae, whereas *sindensis* possesses this; moreover, *Miscellanea* has a coarsely perforate spiral lamina, whereas *sindensis* does not.

(e) In *Chordoperculinoides*, as exemplified by its type species, the spiral lamina is coarsely perforate throughout, whereas it is not in *sindensis*.

For these reasons the writer considers that *Sindulites*, as exemplified by its type species *O. sindensis*, is generically distinct from *Operculina*, *Palaeonummulites* (synonyms *Operculinella* and *Operculinoides*), *Chordoperculinoides*, *Miscellanea*, and *Nummulites* (synonym *Ranikothalia*).

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